a metal seed layer on said first photoresist layer and an inkjet orifice formed in said metal seed layer; and

a Ni layer on top of said metal seed layer with an aperture formed therein in fluid communication with said inkjet orifice.

Claim 14 has been amended as follows:

14. (Amended) A thermal bubble inkjet head having a symmetrical heater according to claim 11, wherein said first insulating material layer is a SiO_2 layer or a Si_3N_4 layer.

REMARKS

Thorough examination and careful review of the application by the Examiner is noted and appreciated.

Claims 11-20 are pending in the application. Claims 11-20 stand rejected.

Objection To The Drawings

The drawings are objected to by the Examiner for the duplicate usage of numeral "52" for a photoresist layer and for an ink passageway.

The Applicants respectfully submit that the first and second insulating material layer 16 and 18 are shown in Figs. 1A-1D.

Figures 1L, 1M, 1N, 2D, 2E and 3 have been amended to alleviate the Examiner's objections. A redlined copy is hereby submitted for the Examiner's approval.

Objection To The Specification

The language at page 16, lines 3-6 is objected to for not making sense. The Applicants respectfully submit that the language indicates that a developing step is not executed after an imaging or exposure step such that the exposed portion 44 and the unexposed portion 38 are able to support a subsequently deposited layer of metal 46. It is only after the deposition and the definition of the metal layer 46 is completed, the unexposed portion 38 of the photoresist layer is removed. The Examiner's objection is respectfully traversed.

The "injection orifice" is corrected and amended to "ejection orifice" as per the suggestion of the Examiner.

The term "ink passageway" is used consistently to describe "52" in the figures.

The title of the invention is correct as shown in the specification "Integrated Micro-Droplet Generator". The Applicants apologize for including an erroneous title on the Response To Office Action filed Nov. 8, 2002.

Claim Rejections Under 35 USC §112

Claims 11-20 are rejected under 35 USC §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention.

Independent claim 11 and dependent claim 14 have been amended to alleviate the Examiner's rejections. A reconsideration for allowance of these claims is respectfully requested of the Examiner.

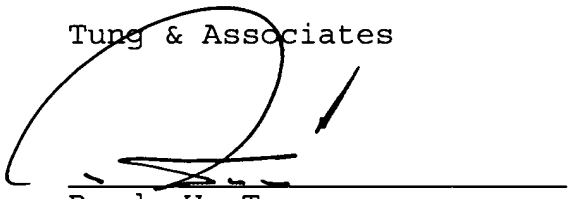
Based on the foregoing, the Applicants respectfully submit that all of the pending claims, i.e. claims 11-20, are now in condition for allowance. Such favorable action by the Examiner at an early date is respectfully solicited.

Attached hereto is a marked-up version of the changes made to the specification, claims and drawings by the current amendment. The attached page is captioned "Version With Markings To Show Changes Made".

In the event that the present invention is not in a condition for allowance for any other reasons, the Examiner is respectfully invited to call the Applicants' representative at his Bloomfield Hills, Michigan office at (248) 540-4040 such that necessary action may be taken to place the application in a condition for allowance.

Respectfully submitted,

Tung & Associates



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VERSION WITH MARKINGS TO SHOW CHANGES MADE

In The Specification

Paragraph 0045 has been amended as follows:

0045 In the next step of the process, shown in Figure 1H, a metal seed layer 46 is deposited on top of the photoresist layer 38,44 and patterned to define an [injection] ejection orifice 48 in the metal seed layer. The metal seed layer may be deposited of a Cr/Ni alloy by sputtering or evaporation and used as a seed layer for a subsequent electroplating process. A fifth photomask is used in a photolithography process to define the size and location of the [injection] ejection orifice 48. The [injection] ejection orifice 48 is formed by a wet etching technique followed by a process for removing the photoresist layer used in the lithography process.

Paragraph 0046 has been amended as follows:

0046 The present invention novel method is followed, as shown in Figure 1I, by a second thick photoresist layer 50 deposition process. The deposition can be carried out by a spin-coating technique and then the photoresist layer 50 is patterned for the [injection passage 52] ink passageway 72. The process is then followed by a photoresist developing process, during which the photoresist layer 50 is removed except at the [injection passage 52] ink passageway 72, which stays on top of the [injection] ejection orifice 48. This is shown in Figure 1J.

Paragraph 0047 has been amended as follows:

0047 An orifice plate 54 is then formed by a nickel electroplating process, as shown in Figure 1K. The residual, second thick photoresist layer 50 in the [injection passage 52] ink passageway 72 is then removed to form the injection passage in fluid communication with the ink chamber 40, as shown in Figure 1L. The

photoresist removal process is performed by a wet etching technique.

Paragraph 0049 has been amended as follows:

0049 In the final step of the process, as shown in Figure 1N, the first thick photoresist layer 38 is removed by a developing solution to vacate the ink chamber 40 in fluid communication with the manifold 20 and the [injection passage 52] ink passageway 72. The present invention novel thermal bubble inkjet head that is equipped with symmetrical heaters is thus completed.

Paragraph 0050 has been amended as follows:

0050 The operation of the present invention thermal bubble inkjet head having an off-shooter arrangement is shown in Figures 2A~2E. At the beginning of the process, the funnel-shaped manifold 20 and the ink chamber 40 are filled with an ink material. The ring-shaped heater electrode 28 is then heated to produce a ring-shaped bubble 70. As a result, a small ink column 74 is pushed

out of the ink passageway [52] 72 through the orifice 48. The bubble 70 enlarges, as shown in Figures 2B and 2C, to further push the ink column 74 out of the [inkjet passage 52] ink passageway 72, as the heater electrode 28 continuously heats the ink contained in the ink chamber 40.

Paragraph 0051 has been amended as follows:

0051 Finally, as shown in Figures 2D and 2E, the ring-shaped bubble 70 forms a circular bubble 76 and thus, cutting off the ink droplet 74 completely from the ink contained in the ink chamber 40. As a result, the [inkjet] ink droplet 74 separates from the inkjet passageway [52] 72 and forms an ink droplet toward the target. After the inkjet droplet 74 departs from the inkjet head 10, the bubble 76 collapses forming a void (not shown).

In the Claims

Claim 11 has been amended as follows:

11. (Amended) A thermal bubble inkjet head having a symmetrical off-shooter heater comprising:

a silicon substrate having a top surface and a bottom surface;

a first [and a second] insulating material layer of at least 1000Å thick on said top [and bottom surfaces] surface;

a funnel-shaped manifold formed in [said second insulating material layer and] said silicon substrate;

a symmetrical ring-shaped heater formed on said first insulating material layer on said top surface;

an interconnect formed of a conductive metal in electrical communication with said ring-shaped heater;

a third insulating material layer on top of said ring-shaped heater and said first insulating material layer;

a first photoresist layer of at least 2000Å thick on top of said third insulating material layer;

an ink chamber formed in said first photoresist layer in fluid communication with said funnel-shaped manifold;

a metal seed layer on said first photoresist layer and an inkjet orifice formed in said metal seed layer; and

a Ni layer on top of said metal seed layer with an aperture formed therein in fluid communication with said inkjet orifice.

Claim 14 has been amended as follows:

14. (Amended) A thermal bubble inkjet head having a symmetrical heater according to claim 11, wherein said first [and second] insulating material layer[s are] is a SiO_2 layer or a Si_3N_4 layer.